

CLAIMS:

1. A Quadrature Error Corrected Digital Waveform Synthesizer (QECDWS) associated with a synthetic aperture radar (SAR), comprising:

a dual accumulator, including frequency and phase, to generate the necessary quadratic phase term (ϕ_i); and

a PEC RAM addressed by the instantaneous frequency (f_i) output of the dual accumulator.

2. The invention of claim 1 further comprising a built-in loop capability, wherein inclusion of the built in loop allows the system to be calibrated to mitigate the non-linear phase contributions of the SAR.

3. The invention of claim 2 wherein the effect on a fine-resolution SAR is to sharpen impulse response of the radar to maximize effective resolution capability and optimize image quality in the range dimension.

4. The invention of claim 1 wherein quadrature amplitude and phase errors are compensated for with correction coefficients stored in a Quadrature Error Correction (QEC) RAM including a RAM for phase and a RAM for magnitude, wherein the QEC phase RAM output is added to the instantaneous phase of a cosine branch of a SINE/COSINE ROM.

5. The invention of claim 4, wherein amplitude correction from the QEC magnitude RAM is applied to one of two multipliers located at each of the sine and cosine ROM outputs, wherein a determination as to which multiplier is “active” is based on the sign of the twos-compliment output of the QEC MAG RAM.

6. The invention of claim 5 further comprising a pseudo-random noise dither generator, wherein problematic upconverter local oscillator (LO) leakage correctable when precision DC offsets are applied over the chirped pulse using a pseudo-random noise dither.

7. A Quadrature Error Corrected Digital Waveform Synthesizer (QECDWS) associated with a synthetic aperture radar (SAR), comprising:

a dual accumulator, including frequency and phase, to generate the necessary quadratic phase term (ϕ_i);

a PEC RAM addressed by the instantaneous frequency (f_i) output of the dual accumulator; and

a built-in loop, wherein inclusion of the built in loop allows the system to be calibrated to mitigate the non-linear phase contributions of the SAR.

8. The invention of claim 7 wherein the effect of the dual accumulator and PEC RAM is sharpened radar impulse response through maximized effective resolution capability and optimized image quality in the range dimension.

9. The invention of claim 7 wherein quadrature amplitude and phase errors are compensated for with correction coefficients stored in a Quadrature Error Correction (QEC) RAM including a RAM for phase and a RAM for magnitude, wherein the QEC phase RAM output is added to the instantaneous phase of a cosine branch of a SINE/COSINE ROM.

10. The invention of claim 9, wherein amplitude correction from the QEC magnitude RAM is applied to one of two multipliers located at each of the sine and cosine ROM outputs, wherein a determination as to which multiplier is "active" is based on the sign of the twos-compliment output of the QEC MAG RAM.

11. The invention of claim 7 further comprising a pseudo-random noise dither generator, wherein problematic upconverter local oscillator (LO) leakage correctable when precision DC offsets are applied over the chirped pulse using a pseudo-random noise dither.

12. A method for correcting phase errors associated with synthetic aperture radar (SAR) systems using a Quadrature Error Corrected Digital Waveform Synthesizer (QECDWS), comprising:

utilizing frequency dependent phase error corrections to pre-distort phase characteristic of chirp associated with a radar system to compensate for frequency dependent phase nonlinearity of RF and microwave subsystems associated with the radar;

applying frequency dependent correction vectors to quadrature amplitude and phase of the radar's synthesized output, wherein quadrature corrections cancel the radar system's quadrature upconverter errors to null the unwanted spectral image; and

generating an RF waveform having a theoretical chirp bandwidth equal to the QECDWS clock frequency of about 1 to 1.2 GHz with a high Spurious Free Dynamic Range (SFDR) necessary for high dynamic range radar systems such as a SAR.

13. The method of claim 12, wherein problematic upconverter local oscillator (LO) leakage can be corrected by applying precision DC offsets over the chirped pulse using a pseudo-random noise dither, wherein a dither technique is used that can effectively produce a quadrature DC bias including precision required to substantially suppress LO leakage.

14. The method of claim 12, further comprising the step of employing a calibration technique to calculate quadrature correction vectors and LO-nulling DC offsets using radar built-in test capability associated with the SAR.

15. The method of claim 12, further comprising the step of separating unwanted LO leakage signals and quadrature image terms in Doppler, wherein said separating step spaces unwanted LO leakage from wanted quadrature images to be quantified individually.

16. The method of claim 15 wherein said step of separating enable introduction of a two-dimensional search algorithm to iteratively null the unwanted LO leakage signals.

17. The methods of claim 14 wherein the LO leakage and the quadrature image terms result in chirped waveforms in the IF spectrum.

18 The invention of claim 12 further comprising the step of applying DC offsets over the chirped pulse using pseudo-random noise dither to correct problematic upconverter local oscillator (LO) leakage.

19. the method of claim 18 wherein DC offsets are applied over the chirped pulse using a pseudo-random noise dither generator